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ABSTRACT

As the use of the Web is perceived to be an effective tool for dissemination of research findings for the provision of asynchronous instruction, the issue of accessibility of Web page information will become more and more relevant. The World Wide Web consortium (W3C) has recognized a disparity in accessibility to the Web between persons with and without disabilities and has responded by developing a set of Web page design standards that specifically address the issue of Web accessibility. The W3C has embraced the issue of accessibility through its Web Accessibility Initiative (WAI). The WAI has developed a set of guidelines, the Web Content Accessibility Guidelines, for use by Web page authors to incorporate accessibility features into the design of Web pages. The purpose of this paper is to describe Web page design principles and strategies based on the WAI's guidelines that will facilitate the development of Web pages that open the gates of the virtual kingdom to persons with disabilities. Web page authoring tips are provided for using the following in a Web page: tables, frames, multimedia, color and backgrounds, and hyperlinks, as well as using alternative Web pages. (AEF)

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ED 455 823

UNLOCKING THE GATES TO THE KINGDOM: DESIGNING WEB PAGES FOR ACCESSIBILITY

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Although the use and availability of information resources on the Internet have skyrocketed over the last few years, cyberspace has predominantly been a domain of persons without physical or mental disabilities. While the Internet is easily accessible to individuals without disabilities, for all practical purposes the gates to cyberspace have been closed and locked for persons with disabilities. According to Tim Berners-Lee, World Wide Web Consortium Director and inventor of the World Wide Web, "*The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect.*"

The development of web pages that exclude persons with disabilities is unfortunate because these individuals often have the most to gain from Internet technology. Access to Internet technology has the potential to increase or enhance the productivity and independence of persons with disabilities. In fact, access to the Web may be more critical for individuals with disabilities than for the general population who can access information resources using conventional delivery systems. For example:

- Persons with disabilities may be location-bound. These individuals could use the Internet to shop for almost anything, research health questions, participate in on-line discussions, and contact friends and family.
- Persons who are blind may wait indefinitely for information to be made available in Braille or audiotape formats. These individuals could use the Internet to acquire access to the same information at about the same time it is available to persons who are sighted.
- Persons who are unable to hold a pen or use a mouse or keyboard could use speech recognition software to accomplish the daily routines and tasks of life.

While it is difficult to identify who uses the Internet, a variety of organizations and methods have been used to capture data that defines the audience of Internet users. Kaye (2000) analyzed national survey data to determine computer and Internet use among people with disabilities to determine that people with disabilities have considerably less access to the Internet when compared to people with no disabilities--11.4% versus 31.1%. Kaye concluded that while people with disabilities have the most to gain from Internet technology, the potential benefits of this technology are far from being realized. According to Kaye the problem is one of access that is a result of limited ownership of computer technology and specialized software by persons with disabilities and the lack of user interfaces that encourage use of the technology among people with disabilities.

The Georgia Tech Graphics, Visualization and Usability Center (GVU) conducts a large scale survey in April and October of each year (available at http://www.gvu.gatech.edu/ user_surveys/). Beginning with the second survey conducted in October, 1994, respondents were asked about their disability status. In October, 1994, 5.11% of the respondents indicated they had a disability. The tenth and latest survey conducted in October, 1998, indicated that the proportion of respondents with disabilities increased to 7.68%. In all GVU surveys the Vision category was identified by over half the respondents who indicated they have a disability. Although this survey confirms the incidence of Internet use among people with disabilities is low (approximately 7%-8%) when compared to the general population, these low numbers may be a self-fulfilling indication that people with disabilities do not have access to the Internet or have difficulties in accessing information on the World Wide Web.

Web pages often do not allow for the eventuality that some web surfers may not be able to see, hear, move, or process some forms of information. Other web surfers may have difficulty reading or comprehending text or may not be able to use a mouse or keyboard. Many experienced web designers and authors, however, are completely unaware of accessibility issues and, therefore, have little or no experience in making their web pages usable by persons who cannot see the screen or use a mouse the same way that the web page authors do. They have what Bartlett (1999) calls a "skewed mindset" in which they develop web pages to convey content visually. Jane Jarrow, president of

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Disability Access and Information Support, explains that there is an art to making web pages more accessible "but people don't think to do it." (Carnevale, 1999).

Adjusting browser preferences and using assistive technologies may lower the access barriers to web pages, but the best method for providing equal accessibility is by building accessibility features into the web site itself (Casey, 1999). Much of what web page authors can do to make web pages more accessible is relatively simple and can be achieved through proper design strategies using the accessibility features of HTML 4.01 and other web authoring resources. Web pages that are accessible to people with disabilities are highly accessible to everyone. Thus, web accessibility is a design issue. Design strategies that create accessible web pages also facilitate the creation of well-designed web pages. Improvements to a web page or site that enable web surfers with disabilities to access it also improve the web page for all surfers.

The World Wide Web Consortium (W3C) has recognized a disparity in accessibility to the Web between persons with and without disabilities and has responded by developing a set of web page design standards that specifically address the issue of web accessibility. Web accessibility is based on design principles that provide for the development of web pages to accommodate the needs of a broad range of users, computers, and telecommunications systems without regard to age or disability. When a web site is accessible, anyone browsing the site should be able to gain a complete understanding of the information presented on the site as well as have an undiminished ability to interact with the site. The W3C has embraced the issue of accessibility through its Web Accessibility Initiative (WAI). The WAI has developed a set of guidelines, the Web Content Accessibility Guidelines, for use by web page authors to incorporate accessibility features into the design of web pages. The purpose of this paper is to describe web page design principles and strategies based on the WAI's guidelines that will facilitate the development of web pages that open the gates of the virtual kingdom to persons with disabilities.

The W3c Web Accessiblity Initiative

Who Is the World Wide Web Consortium?

In October 1994, Tim Berners-Lee, inventor of the Web, founded the World Wide Web Consortium (W3C) at the Massachusetts Institute of Technology, Laboratory for Computer Science (MIT/LCS). The W3C was created to promote and manage the evolution of the Internet and to ensure its interoperability. The W3C has more than 400 Member organizations from around the world and is financed by its members and by public funds. Membership in the W3C is available to any organization. Along with MIT/LCS in the United States, the W3C is jointly hosted at sites in France and Japan and W3C offices are located in 11 other countries.

W3C activities and other work are organized into four domains: 1) Architecture Domain to develop the underlying technologies of the Web; 2) Technology and Society Domain to understand ethical and legal issues from a new international perspective and in light of new technology; 3) User Interface Domain to improve user interaction with the Web including work on formats and languages; and 4) Web Accessibility Initiative to pursue accessibility of the Web through five primary areas of work: technology, guidelines, tools, education and outreach, and research and development. The W3C has published more than 20 technical specifications for the Web's infrastructure since its inception. Each specification not only builds on its predecessor, but is designed to integrate with future specifications as well.

The Web Accessibility Initiative

The Web Accessibility Initiative (WAI) is an official domain of W3C. The WAI works across all the other domains and works internationally in all three host sites of the W3C. The WAI is sponsored by representatives of web development industries, disability organizations, research organizations, and government. Some of the WAI sponsors include the National Science Foundation, National Institute on Disability and Rehabilitation Research, Microsoft, IBM, Lotus Development, and NCR.

To facilitate the efforts of promoting Web accessibility, the WAI joined forces with the W3C HTML Working Group in the design of HTML 4.0 and in December, 1997, HTML 4.0 became a W3C recommendation (see http://www.w3.org/TR/REC-html40/). In May, 1998, an official W3C recommendation for Cascading Style Sheets, Level 2, (CSS2) was issued (see www.w3.org/TR/REC-CSS2/). In May, 1999, the WAI issued the Web Content Accessibility Guidelines 1.0 (see www.w3.org/TR/WAI-WEBCONTENT/). These guidelines incorporated the recommendations of HTML 4.0 and CSS2 and were intended for use by all web content developers including page authors, site designers, and developers of authoring tools.

Web Content Accessibility Guidelines 1.0

The Web Content Accessibility Guidelines (WCAG) consist of 14 guidelines. Each of the guidelines of the WCAG is comprised of multiple checkpoints or sub-guidelines. Assigned to each of the checkpoints is a priority level that is based on the checkpoint's potential impact on accessibility. Priority 1 checkpoints are "must satisfy" requirements without which some groups will find it impossible to access information in a web page. Priority 2 checkpoints are "should satisfy" requirements without which one or more groups will find it difficult to access information in a web page. Priority 3 checkpoints are "may address" requirements without which one or more groups will find it somewhat difficult to access information in a web page.

The WCAG provide for three levels of conformity to the guidelines: Level A, AA, and AAA. For Level A conformity, all Priority 1 checkpoints are satisfied; for Level AA all Priority 2 checkpoints are satisfied; for Level AAA all Priority 3 checkpoints are satisfied. Conformance levels are cumulative. For example, Level AAA conformance would indicate that a web page conforms to Priority 1, 2, and 3 checkpoints. Web pages can display logos to indicate a claim of conformance to a specified level of conformity with the WCAG 1.0.

The WCAG are formulated around two general web page design strategies: *ensuring graceful transformation* and *making content understandable and navigable*:

3. Ensuring Graceful Transformation. Web surfers may operate in contexts very different from the one in which a web page is developed. Therefore, web pages should transform gracefully. A page transforms gracefully when it remains accessible despite any constraints that may include (though not be limited to) physical, sensory, and cognitive disabilities, work constraints, and technological barriers. For example, a web surfer may not be able to see, hear, move, or use a keyboard or mouse, or may have difficulty reading or comprehending text. The surfer may have a small screen, a slow Internet connection, an early version of a browser, a different browser, a voice browser, or a different operating system. For web pages to transform gracefully, structure must be separate from presentation. Structure refers to the logical organization of a page while presentation refers to how a page is rendered, such as print, computer graphics, text, or synthesized speech. The theme of graceful transformation is addressed primarily by Guidelines 1 to 11.

- Making Content Understandable and Navigable. Web page authors should make page content understandable and navigable. The language of a web page should be clear and simple, but also provide understandable mechanisms for navigating within and between pages. Providing navigation tools and orientation information in web pages maximizes accessibility and usability. Not all surfers can make use of visual clues such as image maps, proportional scroll bars, side-by-side frames, or graphics that guide sighted users with graphical desktop browsers. Web surfers may also lose contextual information when they can only view a portion of a page, either because they are accessing the page one word at a time as with a speech synthesizer or a Braille display, or one section at a time as with a small or magnified display. Without orientation information, users may not be able to understand very large tables, lists, or menus. The theme of making content understandable and navigable is addressed primarily in Guidelines 12 to 14.

Designing Accessible Web Pages

Principles of Accessible Web Design

The WAI has produced an extensive set of guidelines for authoring accessible web pages. Since the Guidelines are a technical document that may be somewhat overwhelming to a beginning web author, the HTML Writers Guild (see www.hwg.org) has proposed six principles of accessible web design upon which the WCAG were written. The following principles are the basic rules for accessible design that formed the specific instances described in each individual entry in the guidelines (Bartlett, 1998):

1. Create pages that conform to accepted standards. Use the W3C recommendations for WCAG, HTML 4.01, and CSS2 for designing web pages.
2. Know the difference between structural and presentation elements. For example, <EM>, <ADDRESS>, and <LI> are structural elements while <B> and <CENTER> are presentation elements. Use HTML structural elements to convey page content and style sheets to convey page presentation and formatting.
3. Use HTML 4.01 features to provide information about the purpose and function of elements. Attributes such as TITLE and CLASS allow the web author to provide additional information on the function and meaning of particular tags, thus increasing the accessibility of the page.
4. Ensure that pages can be navigated by keyboard. For example, using client-side image maps with the ALT tag and ACCESSKEY attribute will accommodate keyboard navigation by a browser agent.
5. Provide alternative or text-based methods to access non-textual content that includes images, scripts, multimedia, tables, forms, and frames for user agents that do not display them.
6. Be careful of common programming techniques that can reduce the accessibility of your site such as ASCII art, blinking text, or adjacent links that are separated by non-printable characters.

HTML 4.01

HTML 4.01 is W3C's recommendation for the latest version of HTML. HTML 4.01 was released on December 24, 1999, and fixes bugs in the HTML 4.0 specification, which for instance, omitted the name attribute on the IMG and FORM elements. HTML 4.01 defines the semantics and data types for HTML. HTML 4.01 includes mechanisms for style sheets, scripting, embedding objects, improved support for right to left and mixed direction text, and enhancements to forms for improved accessibility for people with disabilities. HTML 4.01 is specified according to three variants:

1. *HTML 4.01 Strict* excludes the presentation attributes and elements that the W3C expects to phase out as support for style sheets matures. Web authors should use the Strict DTD when possible, but may use the Transitional DTD when support for presentation attribute and elements is required.
2. *HTML 4.01 Transitional* includes presentation attributes and elements that W3C expects to phase out as support for style sheets matures. Web authors should use HTML 4.01 Strict when possible, but may use Transitional when support for presentation attributes and elements is required
3. *HTML 4.01 Frameset* is used for documents with frames. This variant is identical to the HTML 4.01 Transitional except for the content model of the "HTML" element: in frameset documents, the "FRAMESET" element replaces the "BODY" element.

The web author designates which of these variants are used on a web page by inserting a line called a Document Type Definition (DTD) at the beginning of the document. This line is used by the validation service to determine the variant of HTML 4.0 that is used on a page. Each variant has its own DTD. For example, the DTD for a web page that is HTML 4.01 Transitional is:

<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">

The complete HTML 4.01 specification is available in English in several formats, including HTML, plain text Postscript, and PDF at http://www.w3.org/TR/1999/REC-html401-19991224.

Cascading Style Sheets

Cascading style sheets (CSS) facilitate accessibility to web pages by separating document structure from presentation. CSS2 is the current specification for cascading style sheets and is a recommendation

of the W3C. A discussion of the accessibility features of CSS2 may be found at www.w3.org:80/TR/CSS-access.

Style sheets were designed to allow precise control over page presentation properties such as character spacing, text alignment, object position on the page, audio and speech output, or font characteristics apart from markup. By separating style from content, web authors can simplify the HTML in their documents while making the documents more accessible at the same time. CSS facilitates accessibility in several ways:

- **Tag misuse**. CSS2 allows precise control over spacing, alignment, and positioning, thus, eliminating the practice of misusing a structural element for stylistic effects. For example, the BLOCKQUOTE and TABLE elements in HTML are intended to mark up quotations and table data, but are frequently used to create visual effects such as indentation and alignment.
- **Image misuse**. CSS2 positioning properties eliminate the need for invisible images to position content.
- **Font control.** CSS2 provides for precise control over font size, color, and style.
- **User override**. CSS2 allows users to override author styles and to view documents with their own preferred fonts, colors, and styles by specifying them in a user style sheet.
- **Orientation and navigation**. CSS2 provides support for automatically generated numbers, markers, and other content that assists surfers in staying oriented within a document. Long lists, tables, or documents are easier to navigate when numbers or other contextual clues are provided in an accessible manner.
- **Aural style sheets**. Aural style sheets are used to specify how a document sounds when rendered as speech. Aural style sheets allow authors and users to specify properties such as the volume of spoken content, background sounds, and spatial properties for sound that can add effects to synthesized speech. These effects correspond with those achieved with styled fonts for visual output.

Style sheets minimally should provide declarations for all structural elements used in the HTML source. Web pages using CSS essentially need to be unadorned or unformatted. To create a web page with CSS, use HTML code with few or no *deprecated* HTML tags. Deprecated tags are HTML tags that are part of the HTML specification but are expected to be phased out of subsequent versions of HTML.

Style declarations can be embedded at the beginning of an HTML document using a STYLE tag (e.g., <STYLE> </STYLE>) or embedded inside elements in HTML (called inline styles) using a STYLE attribute (e.g., <H1 STYLE="text align: center">Heading Level One</H1>). Style sheets external to HTML documents can be linked to these documents. All methods of style declarations can be used in a single web page.

Validation Services

BOBBY. Bobby (http://www.cast.org/bobby/) is a web-based tool that analyzes web pages for accessibility according to the WCAG. Bobby is offered as a free public service by the Center for Applied Special Technology (http://www.cast.org) to facilitate its mission to expand opportunities for people with disabilities through the innovative uses of computer technology. Although Bobby is an on-line, web-based validation service, Bobby also requires a manual examination of those components of a web page that Bobby cannot examine automatically.
Bobby's analysis of accessibility is based on the W3C's Web Content Accessibility Guidelines. The combination of automatic and manual examination of a web page makes Bobby Approved status equivalent to WAI Conformance Level A--that is, all Priority 1 items have passed.

For example, to become Bobby approved, a Web site must:
6. provide text equivalents for all non-text elements (i.e., images, animations, audio, video)
7. provide summaries of graphs and charts
8. ensure that all information conveyed with color is also available without color

9. clearly identify changes in the natural language of a document's text and any text equivalents (e.g., captions) of non-text content
10. organize content logically and clearly
11. provide alternative content for features (e.g., applets or plug-ins) that may not be supported

Bobby also analyzes web pages for compatibility with various browsers. Analysis is based on documentation from browser vendors when available. Bobby automatically checks sites for compatibility with HTML 4.0. For accessibility and tag compatibility with browser specifications other than HTML 4.0, use the Advanced Options of Bobby. Once a web site receives a Bobby Approved rating, it is entitled to use a Bobby Approved icon on its web pages. Additionally, a Bobby approved web site is eligible for listing in the Bobby Approved Database at http://dev.cast.org/bobby/approved_database.cfm. This database may draw positive attention to a Web site and help others understand that Web accessibility is an important initiative.

Bobby is only one step in the process of making a site accessible to as many people as possible. CAST recommends that web developers use Bobby as a first step to ensure accessible web page design. Other web-based tools are available to analyze web pages for their conformance to the accessibility guidelines, HTML 4.01, and CSS2:

1. **HTML 4.01.** To validate a web page for HTML 4.0, the page must contain a Document Type Definition (DTD) at the beginning of the page. The validation tool knows which variant of HTML 4.01 is being validated based on the DTD. The HTML validator can be accessed at http://validator.w3.org/. The HTML validator provides validation by URL or by uploading HTML into the validator. Web authors can validate the HTML used in the web pages for conformancy with the HTML 4.01 recommendation, and web pages that validate can display a logo to identify the conformance claim.

2. **CSS2.** A validator for CSS2 can be downloaded from http://jigsaw.w3.org/css-validator/ or validated by URL, by entering CSS text into the validator, or by uploading CSS text into the validator. Validating style sheets requires the use of valid HTML. Web authors can validate the style sheets used in the web pages for conformancy and style sheets that validate can display a logo to identify the conformance claim

Validation Procedures

Validation of accessibility is a continuous process. Validation of accessibility should be performed with both automatic tools and manual examination. Validation procedures should be followed even at the earliest stages of web page development where accessibility issues are easier to identify, correct, or avoid. To assist in web page design and validation, the W3C provides a Checklist of Checkpoints for Web Content Accessibility Guidelines 1.0 at http://www.w3.org/TR/1999/WAI-WEBCONTENT-19990505/full-checklist.html. A table containing a checklist with the Priority 1 Guidelines is provided at the end of this article.

When developing web pages, the following validation methods will facilitate the development of accessible web pages that conform to the WCAG:

9. Use an automated validation tool and browser validation tool but remember that automated tools do not address all accessibility issues.
10. Validate source syntax (HTML, XML, etc.).
11. Validate style sheets (CSS2, etc.).
12. Test web pages with a text-only browser.
13. Test web pages with multiple graphics browsers and browser versions.
14. Test web pages with browser or screen reader.
15. Test web pages with multiple screen resolutions.
16. Test web pages with spelling and grammar checkers

A Quick Guide For Developing Accessible Web Pages

The following web page authoring tips provide a quick guide for establishing WAI Level A conformity (see checklist at www.w3.org/TR/1999/WAI-WEBCONTENT-19990324/full-checklist.htmland) and Bobby Approval of a web page. A more comprehensive discussion of techniques that implement the checkpoints is defined in the WCAG at http://www.w3.org/TR/WAI-EBCONTENT-TECHS/. Additionally, The W3C has developed and published a downloadable *Curriculum for Web Content Accessibility Guidelines 1.0* slide set at http://www.starlingweb.com/wai/wcag/. Several of the following examples are provided in the example set of this curriculum at http://www.starlingweb.com/wai/wcag/oversam.htm *(Chuck Letourneau & Geoff Freed, Copyright © 2000 W3C).*

Using Images in a Web Page

- Provide client-side image maps instead of server-side image maps except where the regions cannot be defined with an available geometric shape. When using image maps, use the ALT tag for each image and image map link and provide a text version of the links of an image map elsewhere on the web page. For a client-side image map, describe the destination to which each active area will link. For example:

```
<A HREF="../index.html">
    <IMG SRC="../gifs/logo.gif" WIDTH="630" HEIGHT="111" ALIGN="top" border="0"
    naturalsizeflag="3" ALT="Graphic Header Image with Mapped Links to other pages"
    USEMAP="#insideheaderb55d8d01">
    <MAP NAME="logo55d8d01">
            <AREA HREF="newsletter.html" COORDS="534,85,625,108" SHAPE="rect"
            ALT="Link to Newletter Page">
            <AREA HREF="staff.html" COORDS="462,86,533,108" SHAPE="rect"
            ALT="Link to Staff Page">
            <AREA HREF="syscomp.html" coords="100,85,193,108" SHAPE="rect"
            ALT="Link to System Components Page">
    </MAP>
</A
```

- Bitmapped text images cannot be read by a screen reader and should also use the ALT tag. For example,

```
<IMG SRC="wai-lg.gif" ALT="Graphical Link to Web Accessibility Initiative">
```

- Images or buttons with links should be large enough to allow surfers who use an alternate type of pointing device with their computer to easily select the image.

Using Tables in a Web Page

a. Use tables primarily to convey statistical data or organized information. For data tables that have two or more logical levels of row or column headers, use markup to indicate data cells <TD> and header cells <TH>.

b. Restrict the use of tables for layout of web pages. Use Cascading Style Sheets to layout and format text and images on a web page instead of tables. If a table is used for formatting text, use the SUMMARY tag. For example:

```
<TABLE width="640" border="0" CELLSPACING="0" CELLPADDING="4"
SUMMARY="This table is for formatting purposes only.">
```

c. If tables are used for formatting and placement, test them in a text-only browser such as Lynx to verify that a text-only browser will display your content properly or with a browser reader to determine that the layout of your web page is comprehensible to users of assistive technology.

Using Frames in a Web Page

- Title each frame in a web page to facilitate frame identification and navigation. For example:

<FRAME SRC="tocleft.html" TITLE="Table of Contents Frame">

- If possible, do not use frames in a web page because frames cause difficulty in printing, viewing, and navigation for all users, not just those with physical disabilities.

Using Applets and Scripts in a Web Page

a. Ensure that pages are usable when scripts, applets, or other programmatic objects are turned off or not supported.

b. If pages are not usable when turning off applets and scripts, provide equivalent information on an alternative accessible page.

Using Multimedia in a Web Page

- Provide an associated auditory description or text transcript and provide a link to the text transcript for the important information of a multimedia presentation.

- Synchronize captions or auditory descriptions of the visual track for any time-based multimedia presentation with the presentation. At present there are three formats or languages that support the ability to synchronize equivalent alternatives. These formats are Apple's QuickTime, the W3C's SMIL (Synchronized Multimedia Integration Language) and Microsoft's SAMI (Synchronized Accessible Multimedia Interchange).

- Interactive content that requires the surfer to press a key should not be time-limited and animations that use text should show the text long enough for a slow reader to read it.

Using Alternative Web Pages

1. If it is not possible to create an accessible page, provide a link to an alternative page that uses W3C accessibility technologies, has equivalent information and functionality, and is updated as often as the original page. Because it is difficult to keep alternative pages up to date with the full content of the original page, alternative pages should be provided only after all other pertinent techniques outlined in the WCAG have been attempted. One common way to give surfers a choice is to use the following HTML near the top of an opening page:

   Welcome to the Web Accessibility Page!
   <A HREF="textversionpath/textversionpage">For a text version of this site, follow this link.</A>

2. Provide an alternative to web form submission such as phone number, fax number, e-mail address, or postal mail address to submit information. Even though a form may be accessible, there may be other ways of filling it out without using the web that are more convenient and less time-consuming for the surfer with disabilities.

Using Color and Backgrounds in a Web Page

1. Use adequate contrast between text and background colors as well as colors used in graphics. Dark text against a light background provides the most contrast for people with low vision. Do not use color to convey information unless the information is also clear from the markup and/or content of the displayed text.

2. Avoid using busy patterns or brightly colored background images. Do not tile an image as a background that will distract from the text or make it difficult to distinguish between the background and foreground elements.

3. Make sure your web pages can be viewed on a monochrome or grayscale monitor. A web page that can be viewed in grayscale or monochrome can also be printed without loss of information.

Using Hyperlinks in a Web Page

a. Use text for links that make sense when read out of context. For example, a link that says "Click Here" has no meaning out of context. Link text should be descriptive, yet not too long, for it may cause difficulty for screen-enlarging software:

<A HREF="access.html">Follow this link to the Web Accessibility Page.</A>,
displays like this on a web page:

Follow this link to the Web Accessibility Page.

While HTML code like this:
To go to the Web Accessibility Page, <A HREF="access.html">click here.</A>
displays like this on a web page:

To go to the Web Accessibility Page, click here.

b. Insert printable, non-link characters between links that are adjacent, such as an asterisk (*) or a vertical line (|). Visually impaired users and screen readers may have difficulty distinguishing between links that are separated only by a space.

To display text links like this:

[Goals | Components | Training Calendar | Best Practices | Resource Center | Staff | Newsletter]

use HTML code like this:

```
[<A HREF="goals.html">Goals</A>
| <A HREF="syscomp.html">Components</A>
| <A HREF="training.html">Training Calendar</A>
| <A HREF="bestdocs.html">Best Practices</A>
| <A HREF="rescenter.html">Resource Center</A>
| <A HREF="staff.html">Staff</A>
| <A HREF="newsletter.html">Newsletter</A>]
```

Conclusion

As the use of the Web is perceived to be an effective tool for dissemination of research findings or for the provision of asynchronous instruction, the issue of accessibility of web page information will become more and more relevant. The W3C has embraced the issue of accessibility through its Web Accessibility Initiative and essentially thrown open the gates to the virtual kingdom for persons with disabilities. Web accessibility is a design issue and the benefits of developing accessibility features in web pages easily offsets the additional time and labor requirements for authoring accessible web pages. Because of the commitment of the W3C to web accessibility and the availability of resources and tools for web authors to use in the development of accessible web pages, new and experienced web authors have a compelling mandate for including accessibility features in the design of web pages.

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